

Claims

1. A DNA sequence encoding a cyclin-dependent kinase inhibitor or encoding an immunologically active and/or functional fragment of such a protein, selected from the group consisting of:
 - (a) DNA sequences comprising a nucleotide sequence encoding a protein comprising the amino acid sequence as given in SEQ ID NO: 2, 4 or 6;
 - (b) DNA sequences comprising a nucleotide sequence as given in SEQ ID NO: 1, 3 or 5;
 - (c) DNA sequences comprising the nucleotide sequence encoding a protein comprising the amino acid sequence from amino acid position 75 to 209 of SEQ ID NO: 2 or from amino acid position 11 to 216 of SEQ ID NO: 4 or comprising the nucleotide sequence from nucleotide position 305 to 932 of SEQ ID NO: 1;
 - (d) DNA sequences hybridizing with the complementary strand of a DNA sequence as defined in any one of (a) to (c);
 - (e) DNA sequences encoding an amino acid sequence which is at least 30% identical to the amino acid sequence encoded by the DNA sequence of any one of (a) to (c);
 - (f) DNA sequences, the nucleotide sequence of which is degenerated as a result of the genetic code to a nucleotide sequence of a DNA sequence as defined in any one of (a) to (e); and
 - (g) DNA sequences encoding a fragment of a protein encoded by a DNA sequence of any one of (a) to (f).
2. A method for identifying and obtaining a cyclin-dependent kinase inhibitor comprising a two-hybrid screening assay wherein CDC2a as a bait and a cDNA library of a cell suspension as prey are used.
3. The method of claim 2, wherein said CDC2a is CDC2aAt.

4. A DNA sequence encoding a cyclin-dependent kinase inhibitor obtainable by the method of claim 2 or 3 and which has an amino acid sequence at least 30% identical to the amino acid sequence encoded by the DNA sequence of claim 1(a) or claim 1(b).
5. A nucleic acid molecule of at least 15 nucleotides in length hybridizing specifically with a DNA sequence of claim 1 or 4 or with a complementary strand thereof.
6. A vector comprising a DNA sequence of claim 1 or 4.
7. The vector of claim 6 which is an expression vector wherein the DNA sequence is operatively linked to one or more control sequences allowing the expression in prokaryotic and/or eukaryotic host cells.
8. A host cell containing a vector of claim 6 or 7 or a DNA sequence of claim 1 or 4.
9. The host cell of claim 8 which is a bacterial, insect, fungal, plant or animal cell.
10. A method for the production of a cyclin-dependent kinase inhibitor or an immunologically active and/or functional fragment thereof comprising culturing a host cell of claim 8 or 9 under conditions allowing the expression of the protein and recovering the produced protein from the culture.
11. A cyclin-dependent kinase inhibitor or an immunologically active and/or functional fragment thereof encodable by a DNA sequence of claim 1 or 4 or obtainable by the method of claim 2, 3 or 10.
12. An antibody specifically recognizing the cyclin-dependent kinase inhibitor of claim 11 or a fragment or epitope thereof.

13. A method for the production of transgenic plants, plant cells or plant tissue comprising the introduction of a DNA sequence of claim 1, 4 or 5 or a vector of claim 6 or 7 into the genome of said plant, plant cell or plant tissue.
14. The method of claim 13 further comprising regenerating a plant from said plant tissue or plant cell.
15. A transgenic plant cell comprising a DNA sequence of claim 1 or 4 which is operably linked to regulatory elements allowing transcription and/or expression of the DNA sequence in plant cells or obtainable according to the method of claim 13 or 14.
16. The transgenic plant cell of claim 15 wherein said DNA sequence or said vector is stably integrated into the genome of the plant cell.
17. A transgenic plant or a plant tissue comprising plant cells of claim 15 or 16.
18. The transgenic plant of claim 17 in which plant cell division and/or growth is altered.
19. A transgenic plant cell which contains stably integrated into the genome a DNA sequence of claim 1, 4 or 5 or part thereof or obtainable according to the method of claim 13 or 14, wherein the transcription and/or expression of the DNA sequence or part thereof leads to reduction of the synthesis of the cyclin-dependent kinase inhibitor of claim 11 in the cells.
20. The plant cell of claim 19, wherein the reduction is achieved by an antisense, sense, ribozyme, co-suppression and/or dominant mutant effect.
21. A transgenic plant or plant tissue comprising the plant cells of claim 19 or 20.

22. The transgenic plant of claim 21 which displays a deficiency in plant cell division and/or growth.
23. Harvestable parts or propagation material of plants of any one of claims 17, 18, 21 or 22 comprising plant cells of claim 15, 16, 19 or 20.
24. A regulatory sequence of a promoter regulating the expression of a nucleic acid molecule of claim 1 or 4 or of a nucleic acid molecule homologous to said nucleic acid molecule.
25. The regulatory sequence of claim 24 wherein said regulatory sequence is capable of conferring expression of a heterologous DNA sequence in
 - (a) young root meristems, pericycle cells in the vascular tissue, shoot apical meristem, surface and tip of young leaves, the epidermis of the stem of young seedlings, tapetal layer of the anthers in pollen grains, flower buds and mature ovaries, embryos at the globular, heart and torpedo stages, embryonic root;
 - (b) root and shoot apical meristems, young differentiating leaves, flower buds and young flowers, ovary wall, funiculus, ovules and pollen grains, embryo at the globular stage, embryonic root; or
 - (c) main and lateral root meristems and shoot apical meristems, vascular tissue, pericycle, mature ovaries, globular and heart embryonic root.
26. A recombinant DNA molecule comprising the regulatory sequence of claim 24 or 25.
27. The recombinant DNA molecule of claim 26, wherein said regulatory sequence is operatively linked to a heterologous DNA sequence.
28. The recombinant DNA molecule of claim 27, wherein said heterologous DNA sequence encodes a peptide, protein, antisense RNA, sense RNA and/or ribozyme.

29. A nucleic acid molecule of at least 15 nucleotides in length hybridizing specifically with the regulatory sequence of claim 24 or 25.
30. A vector comprising a regulatory sequence of claim 24 or 25 or a recombinant DNA molecule of any one of claims 26 to 28.
31. A cell transformed with a regulatory sequence of claim 24 or 25 or a recombinant DNA molecule of any one of claims 26 to 28 or the vector of claim 30.
32. A method for the production of transgenic plants, plant cells or plant tissue comprising the introduction of a recombinant DNA molecule of any one of claims 26 to 28 or the vector of claim 30 into the genome of said plant, plant cell or plant tissue.
33. A transgenic plant cell which contains stably integrated into the genome a recombinant DNA molecule of any one of claims 26 to 28 or a vector of claim 30 or obtainable according to the method of claim 32.
34. A transgenic plant or plant tissue comprising plant cells of claim 33 or obtainable by the method of claim 32.
35. Harvestable parts or propagation material of a plant of claim 34 comprising plant cells of claim 33.
36. A method for the identification of an activator or inhibitor of genes encoding cyclin-dependent kinase inhibitors comprising the steps of:
 - (a) providing a plant, plant cell, or plant tissue comprising a recombinant DNA molecule comprising a readout system operatively linked to a regulatory sequence of claim 24 or 25;

- (b) culturing said plant cell or tissue or maintaining said plant in the presence of a compound or a sample comprising a plurality of compounds under conditions which permit expression of said readout system;
 - (c) identifying or verifying a sample and compound, respectively, which leads to suppression or activation and/or enhancement of expression of said readout system in said plant, plant cell, or plant tissue.
- 37. A method for identifying and obtaining an activator or inhibitor of cyclin-dependent kinase inhibitors comprising the steps of:
 - (a) combining a compound to be screened with a reaction mixture containing the protein of claim 11 and a readout system capable of interacting with the protein under suitable conditions;
 - (b) maintaining said reaction mixture in the presence of the compound or a sample comprising a plurality of compounds under conditions which permit interaction of the protein with said readout system;
 - (c) identifying or verifying a sample and compound, respectively, which leads to suppression or activation of the readout system.
- 38. A method of producing a plant herbicide comprising the steps of the method of claim 36 or 37 and formulating the compound obtained or identified in step (c) or a derivative thereof in a form suitable for the application in agriculture or plant cell and tissue culture.
- 39. A compound obtained or identified by the method of claim 36 or 37, which is an activator or inhibitor of cyclin-dependent kinase inhibitors.
- 40. A diagnostic composition comprising a DNA sequence of claim 1, 4 or 5, a vector of claim 6 or 7, a protein of claim 11, an antibody of claim 12, the regulatory sequence of claim 24 or 25, the recombinant DNA molecule of any one of claims 26 to 28, the nucleic acid molecule of claim 29, the vector of

claim 30, or the compound of claim 39, and optionally suitable means for detection.

41. Use of a DNA sequence of claim 1, 4 or 5, the vector of claim 6 or 7, the protein of claim 11, the antibody of claim 12, the regulatory sequence of claim 24 or 25, the recombinant DNA molecule of any one of claims 26 to 28, the nucleic acid molecule of claim 29, the vector of claim 30, or the compound of claim 39 for modulating plant cell cycle, plant cell division and/or growth, for influencing the activity of cyclin-dependent protein kinase, for disrupting plant cell division by influencing the presence or absence or by interfering in the expression of a substrate for cyclin-dependent protein kinase, for modifying growth inhibition of plants caused by environmental stress conditions, for inducing male or female sterility, for influencing cell division progression in a host as defined in claim 9 or for use in a screening method for the identification of inhibitors or activators of cell cycle proteins.
42. Use of the compound of claim 39 as growth regulator and/or herbicide.